CLAIMS

What is claimed is:

1. A fuel cell, comprising:

a pair of MEA's separated from each other by a distance, each MEA having an anode side and a cathode side;

a bipolar plate assembly located between the anode side of one of the pair of MEA's and the cathode side of the other of the pair of MEA's, the bipolar plate assembly having:

a first sub-plate with a flow channel which is open to the anode side of the one of the pair of MEA's;

a second sub-plate with a flow channel which is open to the cathode side of the other of the pair of MEA's, the first sub-plate and the second sub-plate being nested together to form a coolant flow channel between the first and second sub-plates.

2. A fuel cell according to Claim 1, wherein the flow channel of the first sub-plate and the flow channel of the second sub-plate are laterally centered with respect to each other to form a plurality of coolant flow channels.

3. A fuel cell according to Claim 2, wherein the flow channels have a surface area and wherein the combined surface area of the plurality of coolant flow channels is greater than the surface area of the flow channel which is open to the cathode side or the surface area of the flow channel which is open to the cathode side.

4. A fuel cell according to Claim 1, wherein the second sub-plate includes a plurality of flow channels open to the cathode side which correspond to the flow channel of the first sub-plate open to the cathode side.

5. A fuel cell according to Claim 1, wherein the coolant flow path has a height dimension which is substantially within a height dimension of the cathode flow path, the anode flow path or both.

6. A fuel cell according to Claim 1, wherein at least one of the flow channel which is open to the anode side or the flow channel which is open to the cathode side, or both provide a serpentine flow path.

7. A method of manufacturing a bi-polar plate assembly useful in a fuel cell, the fuel cell having a plurality of MEA's, each MEA having a cathode side and an anode side, the method comprising:

forming an open channel on a side of a first sub-plate adapted to face the anode side of a MEA;

forming an open channel on a side of a second sub-plate adapted to face the cathode side of an adjacent MEA; and

forming a closed channel between the sub-plates adapted for coolant flow therethrough by nesting the first and second sub-plates together.

8. A method according to Claim 7, wherein the forming steps include providing the respective channels with a height dimension, and wherein nesting the first and second plates together locates the height dimension of the closed channel substantially within the height dimension of one of the open channel adapted to face the anode side of the MEA or the open channel adapted to face the cathode side of the MEA.

9. A method according to Claim 7, wherein the forming steps include providing the respective channels with a height dimension, and wherein nesting the first and second plates together further comprises substantially aligning the height dimension of the cooling channel with the height dimension of the hydrogen flow channel, the oxygen flow channel, or both.

10. A method according to Claim 7, wherein at least one of the steps of forming an open channel is accomplished by stamping a sheet of metal.

11. A method according to Claim 7, wherein the nesting the first and second sub-plates together forms a plurality of coolant flow channels for each anode, each cathode, or both.

12. A method according to Claim 7, wherein the forming steps include forming a plurality of respective channels laterally adjacent each other and wherein the forming steps further comprise spacing the plurality of anode facing channels a first lateral distance apart from each other and spacing the plurality of cathode facing channels a second lateral distance apart from each other that is less than the first lateral distance.

13. A method according to Claim 7, wherein at least one of the forming steps creates a serpentine flow path incorporating the corresponding channel.

14. A method of operating a fuel cell having a plurality of adjacent MEA's, comprising:

passing oxygen through a flow path in communication with a cathode side of the MEA and having a height dimension;

passing hydrogen through a flow path in communication with an anode side of the MEA and having a height dimension; and

passing coolant through a flow path having a height dimension which is substantially aligned with the height dimension of the hydrogen flow path, the oxygen flow path, or both.

15. A method according to Claim 14, further comprising passing the hydrogen through a first effective lateral distance of a diffusion media; and passing the oxygen along a second effective lateral distance of a diffusion media which is less than that of the first effective lateral distance.

16. A method according to Claim 14, wherein passing coolant through the flow path includes passing the coolant through a closed flow channel located between the oxygen flow path and the hydrogen flow path.

17. A method according to Claim 14 wherein passing the coolant through the flow path is accomplished by passing the coolant through a plurality of flow channels.

18. A method according to Claim 14, wherein passing the coolant through the flow path exposes the coolant to an external surface area which is greater than an external surface area of the oxygen flow path or the hydrogen flow path, or both, individually.

19. A method according to Claim 14, wherein passing the coolant through a flow path includes passing the coolant along a pair of opposite lateral sides of a channel of the cathode flow path, of a channel of the anode flow path, or of a channel of both the cathode and anode flow paths.

20. A method according to Claim 14, wherein at least one of the oxygen flow path, the hydrogen flow path, or the coolant flow path is a serpentine flow path.